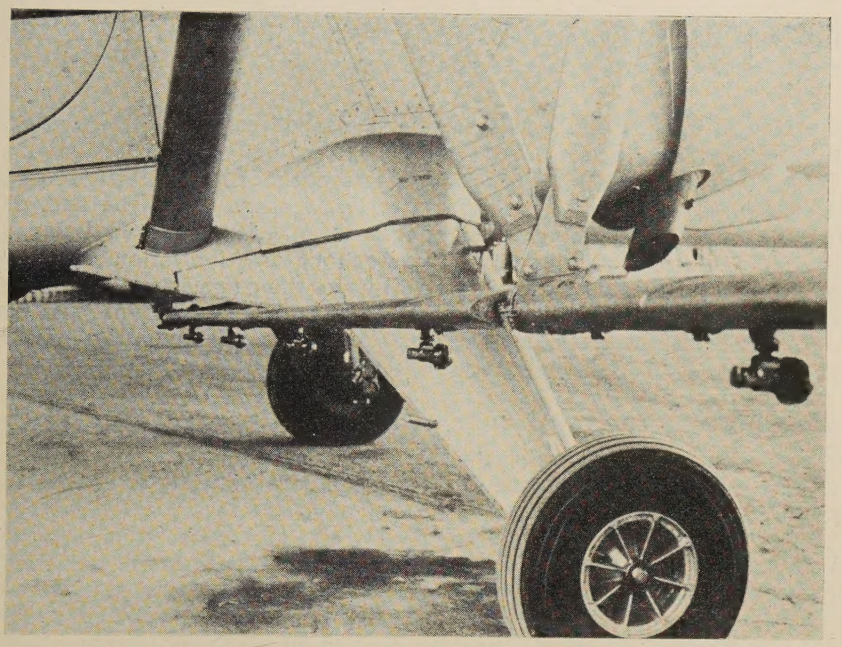
PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER EIGHT

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RUBBER RESEARCH INSTITUTE OF MALAYA
INCORPORATED 1925

September
1953

R R I

LOCATION The Institute's Laboratories and Offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE All *letters* must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of a particular officer, if so desired (See Staff List in Bulletin No. 1, page 24). The address for *telegrams* is Searching, Kuala Lumpur. *Telephone:* Kuala Lumpur 3351/2/3. *Parcels* occasionally arrive without any indication of their origin. It is requested that senders will write their names and addresses clearly on the outside of all packages, and also advise the Institute by letter or telegram of their despatch. This is especially important for perishables, such as latex samples and plant specimens.

PROHIBITED PLANT SPECIMENS Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on pests or diseases or any other matters that may require examination of living material must first submit an inquiry by letter giving the fullest possible description of their problem.

ADVICE Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. *Interviews* should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The Institute is open from 8 AM to 1 PM and 2 PM to 4 PM on Mondays to Fridays, and from 8 AM to 12.30 PM on Saturdays.

EXPERIMENT STATION AND FACTORY This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement with the Director of the Rubber Research Institute (see *Correspondence* above). There is a guest house

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur September 1953 New Series No. 8

Editorial: A Long Range Project

One part of the work of the Pathological Division is long range in more senses than one. It involves investigations started three years ago, directed to evolving a method of eradicating a disease which is nowhere nearer than ten thousand miles away. That disease is South American Leaf Blight. Reasons for regarding seriously the danger of its arrival here, and methods of combatting the threat, were discussed in an article in our third issue.

Dothidella ulei, the fungus causing South American Leaf Blight, is disseminated by wind. When the problem of its eradication was considered it was decided that the only plan holding any promise of success was to defoliate a large area around a discovered infection and to keep the trees bare while the infested area itself was cleaned up with fungicides or fire. Further it was apparent that time would be vital. For success to be achieved it would be necessary to spot the disease quickly and treat the danger area with a minimum of delay. It was to facilitate recognition that we prepared the carefully illustrated pamphlet included in our fifth issue. For the eradicant campaign itself, should it ever become necessary, it was realised that to spread a defoliant fast and far enough would mean using aircraft.

The first problem in the chain of investigations was to select a defoliant. Screening tests were carried out on nursery plants, as may be seen by reference to successive Annual Reports. The material which emerged on top was a hormone type weedkiller — normal butyl 2,4,5-trichlorophenoxyacetate — dissolved in diesel oil. In later tests a small amount of pentachlorphenol was added to make the mixture fungicidal as well. Hormone weed killers are expensive chemicals on a weight basis but are effective in very small amounts. This is of great advantage for aerial application as the limited pay load of the aircraft then suffices for a relatively large area. Hormones have another important merit in that they are absorbed by the plant and distributed through its tissues; it is therefore not necessary for every leaf on the tree to be reached by the spray.

Many factors had to be taken into account in deciding on the type of aircraft to employ — payload, manoeuvrability, safety at low altitude and speed, but above all availability. Clearly aircraft could not be maintained for this sole purpose. It was most opportune that Beaver aircraft were taken into service on the internal air lines in this country, for they had all the desired attributes and could be equipped with spray gear of standard design. Accordingly trials were made with a Beaver chartered from the Federation Air Service, fitted with boom and nozzle spray rig purchased from the de Havilland company.

There were many problems of intercommunication. Ground markers of the type usually employed in crop spraying would not be visible when treating standing trees. Smoke generators, captive balloons and Verey signals were all tested to find their range of usefulness. Contact between ground and air — an essential — was provided by a V.H.F. radio set installed in a Land Rover. The need for a further radio link between ground parties has been recognised.

The spraying equipment was supplied with but little information as to the characteristics of the spray produced. Details had to be found by experiment. Trial flights were made over the airstrip at Port Swettenham, where there is no scheduled service and little other traffic. It was ideal for the purpose. Height, speed and spacing of spray runs were there decided by a procedure that involved spraying coloured oil over a pattern of sampling papers, from which the distribution of droplets of different sizes and the amount of oil deposited were determined.

The first applications of the defoliant from the air were made last year over old rubber about to be replanted. The principal concern was to see that the scheme which was worked out by hand spraying of nursery plants would function on a large scale on large trees. Expectations were realised. Almost complete defoliation resulted from application of only one gallon per acre of oil containing as little as 2% of the hormone. This was most satisfactory for it meant that a Beaver could at this rate treat 200 acres in a single sortie and an actual spraying time of ten minutes. Some information was obtained as to the effect of concentration of the hormone, but results so far are provisional only. Work is proceeding to find out the best dosage in relation to not one but repeated applications, as would be needed in the emergency envisaged. In addition the trials are being taken from flat into undulating land, to find out about operating under more difficult conditions.

In the investigations here described the Pathological Division has been fortunate in receiving advice and assistance of the greatest value from many quarters, in this country as well as from experts and organisations in the United Kingdom.

Some Publications

World Crops have published, in May, a 'Natural Rubber Industry' special issue. Among R.R.I. contributions is a review article, 'Improvement of Yields in Hevea Brasiliensis' by Dr E. Baptist, Head of the Botanical Division. By courtesy of the Editor of *World Crops*, we have reprinted this article and copies are available on request. A brief general article introducing 'The Rubber Research Institute of Malaya' has also been reprinted as a leaflet for visitors to the institute.

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The chronology of rubber which appears in the new book, *History of the Rubber Industry* (Heffer, 1952) commences unexpectedly with the date B.C. 60 - 55,000,000! In 1924 fossilised rubber, believed to date from the Eocene period, was found in lignite deposits in Germany.

Yield Maintenance of Mature Rubber Trees

COMPLETE KNOWLEDGE HAS NOT YET BEEN ACHIEVED of the fertiliser requirements of a rubber tree throughout the full course of its life, partly because detailed nutritional studies of the tree have to be made and partly because we do not know the extent of the economic life of a rubber plant. *Hevea brasiliensis* is a healthy, tough, sturdy grower and may be found 'still going strong' after forty, fifty or sixty years of life.

Information is needed on the fertiliser requirements of trees of all ages, and manuring problems of rubber trees resolve themselves into several categories. From the time of replanting, or of planting, to maturity the trees should have sufficient of the right nutrients to maintain steady growth and health in order that at as early a date as possible tapping may commence and an income be obtained from the trees.

During the next stage of their development when the rubber trees are in tapping, first on virgin bark and then on renewed bark, the question is usually posed — 'when' should these young mature trees start to receive fertilisers so as to obtain the maximum yield for the maximum length of time?

The third and final period when fertilisers may be needed in the tree's existence is in its old age, and then it must be decided whether it should receive further applications or whether it should be earmarked for replanting. This article will discuss aspects of manuring in relation to yield level which arise during the tappable life of the rubber tree.

The level of yield of dry rubber which a group of rubber trees will produce when tapped depends on many factors including:

genetical characteristics (perhaps most important);

health and vegetative condition (controlled by all the agronomic factors of the plant's environment);

conditions of tapping.

Considering the first of these three factors, it has been convincingly demonstrated by the geneticist and plant breeder, from field trials, that the use of carefully selected, tested and 'proved' planting material can raise the yield from a given area to twice or even thrice that of a similar area of unselected seedling trees. Secondary genetical characteristics, which are usually fully considered when testing new planting material, such as quality of bark renewal, tendency to brown bast under tapping, *etc*, are also factors affecting yield.

We know that different yield levels for the same clone can be obtained in different parts of the country, and that these differences are largely due to environment, including variations in the nutrient status of the soil. The magnitude of the yield differences within one clone, however, is relatively small, and far below the yield improvements that plant breeders have introduced.

Finally, the yield performance of rubber trees may be altered appreciably according to the type of tapping cut and its height up the trunk of the tree, by frequency of tapping and rate of bark consumption, by the condition of the bark and its rate of renewal. Other variables in the conditions of tapping are the tapper's skill and the size of his task, and weather conditions.

ECONOMICS OF REPLANTING

It is usually no straight forward task to answer the simple question of a planter: 'Should I manure my rubber trees?'. Even if adequate technical knowledge is available to permit a reasonably definite forecast of the yield trend after manures are applied to the trees, the ultimate decision on manuring will depend on the replanting policy and on the financial condition of the Company.

The economics of replanting of old rubber trees can be reduced to a general formula, if a few reasonable assumptions are made. In effect, costs are set out to compare (A) replanting with (B) retaining and manuring the old trees, over a period of years until the replantings come into tapping:

A. REPLANTING

Estimated replanting costs (5 years)	\$400 per acre (*a*)
Combined yields for 6th & 7th years – 1,000 lb per acre	
Yield for 8th year – 1,000 lb per acre	
Total yield after 8 years	2,000 lb per acre (*b*)

B. RETAINING AND MANURING OLD TREES

Cost of fertilisers after 8 years at \$25 per acre per annum	\$200 per acre (*c*)
Total yield after 8 years at 500 lb per acre per annum.	4,000 lb per acre (*d*)

Thus, at the end of 8th year the replanted area has an adverse balance composed as follows:

Cash expenditure $\$(a - c) + (d - b)$ lb rubber lost

which, on the figures and amounts assumed above, amounts to \$200 expenditure and 2,000 lb rubber per acre.

The net increased yield of rubber per acre per annum which the replanted trees will give is 500 lb, which will offset the deficit of 2,000 lb after four years. The expenditure deficit will require two or three more years before it is liquidated, depending on whether the net profit per lb of rubber is 10 cents or 20 cents, or some other figure.

Hence, on the assumptions regarding expenditure and yield which have been made above, there is a clear advantage in replanting old rubber trees as opposed to manuring them, in that after approximately 15 years the capital expenditure involved in obtaining a new stand of high yielding trees will have been completely recovered. The new trees, being younger, have a much longer expectation of life at a higher yield level than old ones. There are other advantages which should be credited to the replanted rubber which have been excluded by the assumed levels of yield and expenditure given in the example shown above. Thus (*a*) the maximum yield of the replanted trees is likely to be in excess of 1,000 lb per acre which was assumed; (*b*) the yield of the old trees would, in spite of regular manuring, probably decrease gradually with age; (*c*) the manuring requirements of the replanting, after it matures and is tapped, are likely to be less than those of the old trees (the assumption made in the example was that the manuring rates for the two lots of trees would be equal from the 8th year onwards).

MANURING EXPERIMENTS

Manuring experiments have been carried out in the rubber growing areas of the East over a number of years, and most of the published results which are available refer to trials on seedling trees. A brief summary of experiments and results follows.

Experiments started in Sumatra in 1919 on 8 to 9 year old seedlings growing on a poor 'white' alluvial soil, and at that time yielding 200 to 300 lb per acre per annum, showed double the yield of the control in the 3rd year; biennial dressings of nitrogen gave a maximum of 670 lb per acre in the 10th year. On the other hand prolonged experiments on certain 'red' volcanic soils, which showed no initial response, began to give economic returns for manuring after 15 years, at which age deterioration normally sets in on this soil type.

Dunlop nitrogen trials (Malaya), started in 1930 as a simple test of sulphate of ammonia on fields of rubber past their prime, gave an average improvement in yield of 34% in the 6th year (annual manuring) on trees which were initially yielding some 350 lb per acre per annum.

I.C.I. Experiments (Malaya), started in 1931 (biennial manuring) on rubber which at that time ranged from 8 to 19 years old giving from 450 to 700 lb per acre per annum: of the seven experiments recorded, one gave very quick response in yield (12 years old rubber growing on poor quartzite loam and yielding 450 lb), three gave economic response in the 3rd year, two in the 4th and 5th year and one no response. The increase obtained in the different experiments up to the 5th year varied from about 10 to 25%.

Dunlop 25 plot experiments (Malaya). Annual manuring started in 1930-1 on rubber 8 to 22 years of age and yielding from 300 to 650 lb per acre per annum. Of the eleven trials, four fairly quickly gave responses which were considered economic, two began to respond after 3 to 4 years whilst five failed at the 5th year (1936) to give adequate return. Of these five trials four were started before there was obvious need for manuring, leaving one with unexplained poor response. The outstanding successful trial concerned 14 year old backward rubber giving 250 to 350 lb, the yield of which rose to 544 lb in the 5th year.

Manuring experiment at R.R.I. Experiment Station, where continuous manuring from the time of planting was given to seedling trees on a very sandy soil, showed the best effects from a 'complete' fertiliser.

The histories of the pre-war fertiliser experiments on mature seedling rubber show:

a that foliage improvements are general and rapid, but that a quick response in the form of increased yields occurs only with younger stands of badly deteriorated trees growing on depleted, previously cultivated sites.

b that the yield advantages in older and better grown rubber are realised not so much in raised yield levels as in a relative maintenance of yields against an otherwise inevitable deterioration.

c that the effects of manures upon girth increment are more immediate and definite than upon yield. Effects on bark which has renewed within the period of manuring may be appreciable; little is known regarding the effect on bark

which has renewed prior to fertiliser application but it is evident that the effect is neither appreciable nor immediate.

d that nitrogen is the fundamental need and, except on very sandy soils, the addition of minerals to nitrogen or the use of organic forms of fertilisers gives no advantage commensurate with the extra cost.

e that the economic fundamentals of a field of rubber trees change but slowly, and manuring must be regarded as a long term policy.

These pre-war experiments were mostly with comparatively young mature trees, and in those years, with the low costs of tapping and of fertilisers, the yield stimulus to the poorer trees and the maintenance of vigour and yielding capacity of the better trees fully justified the expenditure on manuring.

THE SITUATION NOW

Continuing our consideration of seedling rubber trees of ill defined parentage, the situation has changed appreciably: apart from the greatly increased costs of fertilisers and labour, the trees may now be 25 or 30 years of age, stands per acre are lower and the bark being tapped is often thin, hard and uneven and of varying degrees of renewal. Nowadays, the long term rejuvenation of low yielding old rubber should not be contemplated, but it will be for consideration whether the younger seedling plantings and the earlier budgrafted areas, still in apparently good condition, should be manured.

Such trees appear to have received a substantial boost in vigour because of the enforced rest during the war years. The reduction of competition provided by the clearing of heavy undergrowth coincided with the resumption of tapping in 1946-7 and produced the high 'flush' yields of that period. These yields have now stabilised under organised tapping at a normal level but as many estates will find it necessary to tap this type of rubber for some considerable time, the application of fertilisers must at least receive consideration as a means of maintaining these areas as competitive units.

Yield limits cannot be precisely stated below which expenditure on manuring should not be entertained, but general opinion puts the figure in the region of 600 lb per acre per annum. Clearly this limit will be closely related to fluctuations in the price of rubber, and other factors, apart from yield and vigour of the trees, will need to be considered in assessing the desirability of manuring, such as the age of the trees, the quality and amount of bark available, the rate of bark renewal, and the costs of the fertilisers, which involve type, rate and frequency of the applications.

The rate of growth of a tree falls rapidly as it ages and, for a rubber tree, particularly after it comes into tapping. Normally bark renewal depends largely on the processes of girth expansion and, if girthing is greatly reduced, bark is unlikely to renew to tappable thickness.

The younger the trees at the commencement of treatment, the more likely will it be possible to maintain their vigour, nomal growth rate and renewal of bark, which are essential for their exploitation over an extended period.

The yield of latex from a seedling tree normally increases gradually as the cut moves down the trunk, and there is invariably a drop—sometimes substantial—in yield on turning over to a high cut. Yield fluctuation with height of cut will obtain during the economic life of the tree irrespective of whether or not fertilisers are applied; it is possible that fertilisers may, by gradually improving the quality of the bark, raise the level of high cut yields.

Whilst the use of fertilisers will undoubtedly improve or help to maintain foliage condition, single applications will do no more than produce temporary stimulation, and the best results will be obtained if fertiliser application is regarded as a long term policy for which more or less permanent provision must be made. Sulphate of ammonia is the most economic nitrogen fertiliser, and for old rubber it is usually expected to be the most effective fertiliser if applied regularly over a period of six or seven years at 3 cwt to 4 cwt per acre every two years. Should there be any possibility of the trees coming into a replanting programme in less than 10 years, the maximum fertiliser effects are not likely to be obtained and a scheme of manuring should not be started.

THE MIDDLE AGED TREE

Another category of rubber trees which is increasingly coming under consideration for manuring is that which includes the middle aged trees of up to date high yielding material, both budgrafts and clonal seedlings. Many such areas were replanted after 1930, and during immaturity the trees received generous applications of fertilisers. Even plantings from jungle may have had phosphate fertilisers at the time of planting, but, whether the trees were replanted or not, their agricultural treatment has been much superior to that given to trees planted before, say, 1920. The use of leguminous ground covers and, on steeper land, the provision of contour earth works (terraces and bunds) and contour planting rows, have not only largely eliminated the harmful effects of soil erosion but the continuous existence of soil protecting covers has helped to maintain and build up the physical condition of the surface soils.

The standard of maintenance of these middle aged areas has been good, except during the war period. For the early years of the plant's life the weeding policy, to keep clean the planting rows and terraces, was intended to provide adequate protection to the main area of soil without interfering with the optimum development of the maturing rubber tree. Careful attention to the problem of root disease has been given in replanting operations, prior to removing the old stand of trees as well as later on by regular inspection and treatment of the new trees, and unnecessary losses of trees have been largely avoided. By judicious thinning out at agreed intervals, the density of the trees in the new plantings and replantings has been reduced so as to prevent overcrowding and loss of girth. Finally these trees have been so tapped as to avoid heavy consumption of bark.

Thus the approach to manuring in areas of middle aged, high yielding rubber is often one of maintenance of an existing condition and the prevention of its deterioration.

The background of field experiments is still incomplete for this type of rubber tree. The trials in progress have mostly reached the stage where the trees, about 15 years of age, have had three biennial applications of fertilisers and have at least another year of tapping on virgin bark before renewed bark is reached. The effects of the fertilisers cannot yet be fully assessed but the picture so far obtained is that the changes in girth and yield which have resulted from the applications of manures have been few and small. The conclusion at this stage, therefore, is that for trees which have been planted or replanted under normal conditions and treatment the use of fertilisers after maturity does not appear to be necessary during the first tapping cycle on virgin bark.

THE OLDER TREE

For older high yielding budgrafts and clonal seedlings, 15 to 20 years of age, there is no new information available from manuring experiments, but in such plantings recommendations for treatment are frequently requested to counteract unexpected and apparently unexplainable falls in yield. In seeking to account for these yield decreases, and before deciding whether the use of fertilisers is required, the possibility must first be examined whether obvious factors are involved, such as weather conditions, prolonged wintering or secondary wintering, abnormal loss of crop through wet days, change of tapping system, height of tapping cut and its approach to renewed bark *etc.*

In assessing the desirability of using fertilisers to improve yields, it is as well to remember that practically nothing is known of the physiological relationship between the nutrition of the rubber tree and the production of latex. Tests with young seedlings show that the benefits in growth of the rubber plant which follow the use of the major nutrient elements only produce extra rubber hydrocarbon in proportion to the extra vegetative growth. The yield improvements obtained in the older manuring experiments have always followed growth improvements. These observations suggest that the level of production of latex in a rubber plant is a genetical or inherent characteristic which cannot be influenced by nutrient factors, except in so far as the best yield will come from the plant of best vegetative development, other things being equal.

In an untapped tree, the d.r.c. of the latex is high, and it is generally agreed that there is no circulation or movement of latex in the latex vessels; little or no replacement then of latex is required and the tree is able to put the greater part of its energy into growth. With repeated tapping, the rubber content falls and after a short interval of time, when the rate of manufacture of new latex is balanced by the rate of extraction by tapping, it reaches a constant composition depending on the type of tree and the tapping system. With tapping, therefore, the growth rate of a tree is invariably retarded for the reason that part of the food materials which it manufactures is used in the formation of latex to take the place of that removed. Again it is known that an increase in tapping intensity leads to a lower concentration of the latex in the vessels, but, as a greater yield is generally realised in practice, this implies that the tree is manufacturing rubber at a greater rate. In

young trees this increase in rubber formation is at the expense of growth, but in old trees—which are growing only slowly—it must be made presumably at the expense of food materials already stored. Under conservative methods of tapping old trees there is a lag between the beginning of starvation and its final result in diminishing yields (and a corresponding lag in the observed effects of fertiliser applications as reflected in increased yields), but this period will be substantially reduced by increasing the intensity of tapping.

CONCLUSION

The need for manuring and the results to be expected from fertiliser applications to mature rubber trees should be viewed along the following main lines:

a Fertilisers can, at the best, raise yields only to the capacity of the trees as determined by their genetical constitution.

b Manuring of rubber trees does not appear directly to stimulate the secretion of latex, but merely brings about a gradual improvement in the condition of the trees. Such improvement subject to the non-operation of other factors detrimental to growth, may react favourably on the rate of bark formation which in turn may eventually lead to better yields.

c A single application of chemical fertiliser may result fairly rapidly in improved foliage, but continued manuring will usually be necessary to maintain the initial stimulating effect.

It is impossible to say how the costs of fertiliser equate with the improved or maintained yield of latex which may result. In areas giving substantial yields of latex, the use of fertilisers should be regarded as a form of upkeep intended not necessarily to improve production but to maintain it by retarding both the general deterioration of the trees and the rate of fall of yield over the envisaged period of tapping. Old age will inevitably reduce performance, whether human or botanical specimens are being considered, and an old rubber tree must deteriorate and show some reduction in yielding capacity irrespective of maintenance treatment. Apart from tapping methods and soil conditions, numerous other factors will operate in determining the amount of rubber per acre being produced, and in effect all that can be confidently expected from manuring old rubber trees is that they should produce more rubber over a ten year period than would be obtained without the use of fertilisers.

From an agricultural point of view, the principle of applying fertilisers to retard deterioration and to maintain a level of production is perfectly sound, but the problem becomes, for old seedling trees, an economic one to be considered in terms of expected yields and cash returns over a ten year period, the yielding capacity of the estate as a whole, and the finances of the company. At the back of these considerations come the policy of the company regarding replanting, and the future of natural rubber in relation to world prices and competition with synthetic—neither of which is a subject to be discussed here.

The fertiliser treatment of somewhat younger, but middle aged, high yielding areas has to be considered on the same principles but, because of the higher level of yield and with replanting a much more distant project, it is a better and safer proposition. If there is any doubt when to commence the use of fertilisers, it will be better to start too early than to delay too long until a fall in yield has occurred, because it is easier to maintain yields at a certain level than to build them up to a higher level.

SOILS DIVISION

A Case of Black Stripe

EVERYONE IS FAMILIAR with wounds arising from bad tapping, in which portions of the cambium (the layer of growing cells underlying the bark) are cut away, exposing the wood. These wounds heal rapidly by forming a callus in from the edges. The consequent depressions and burrs which are formed on the renewed panel render future tapping difficult.

When the wounding agent is a parasitic fungus instead of a tapping knife the same type of wound may result. A fungus is liable to cause much more serious damage because, if conditions are favourable, it can grow from the point of infection and destroy healthy renewed bark. Not only does the fungus itself spread but it may produce poisonous substances which damage and discolour cells well into the wood. As the conducting vessels of the tree run in a vertical direction it is to be expected that a fungus or fungus poison will travel in the wood vertically from the point of origin, so that a long streak is produced running up from the tapping cut. This happens with invasion by the damp loving fungus *Phytophthora palmivora,* and gives rise to the name black stripe.

If the disease is untreated, and damp conditions continue to favour growth of the fungus, even the untapped bark below the cut may become infected. Several points of infection will result in several vertical streaks, and where they are close together they may coalesce. The spread of the fungus through the bark tissues can cause sufficient injury to lead to latex bleeding, either internally with the formation of pads of coagulum, or externally through bark fissures.

A case of black stripe observed in 1951 in Negri Sembilan was unusual in that the splitting and latex exudation from the older renewed bark was unassociated with streaks on the surface of the recently tapped bark.

The panel shown in *Figure 1* was photographed as soon as it arrived at the Institute. Our first reaction was to classify it with those indeterminate bark bursts associated with special clones, unusual growth conditions, and wind flexure. However, dissecting the panel with mallet and chisel at once revealed that the apparently healthy surface of the renewed bark concealed a series of a well developed black lines extending right from the tapping cut. A portion of the dissected panel is shown in *Figure 2.* The lines became larger the further away from the cut they were traced, until at six inches above the cut they reached the surface as open splits.

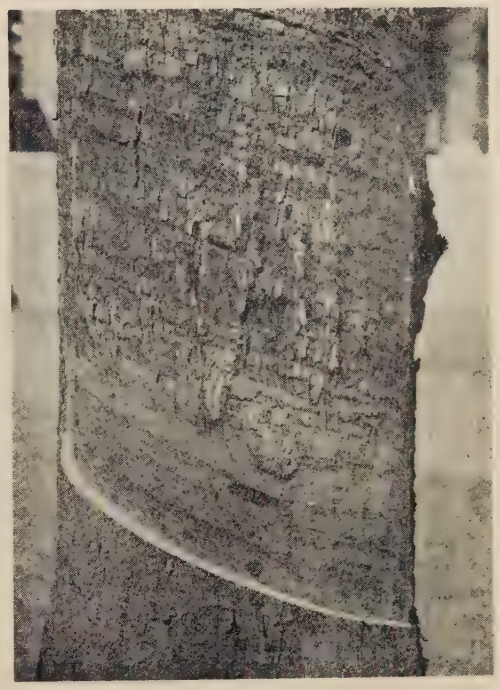

Figure 1. Complete tapping panel showing longitudinal fissures, but absence of symptoms just above tapping cut.

Isolations were made by taking fragments of the tissue and planting in tubes of an agar culture medium. The fungus *Phytophthora palmivora* grew out from the tissue and thus established that the disease was true black stripe.

In considering this rather unusual case it must be borne in mind that the clone was PB 86, which in our experience is susceptible to *Phytophthora* attack and liable to bark bursts. Further, many of the affected trees were leaning in a way which might lead to excessive strains being set up by unbalanced growth or the force of the wind. It is possible that a weakening of the tissues due to the *Phytophthora* attack led to the formation of these fissures under mechanical strain.

Figure 2. Portion of dissected tapping panel showing discoloured streaks under the renewed bark.

Black stripe is not commonly met with in Malaya. We have seen only a few cases since the war, and feel that much has still to be learnt about the symptoms it may exhibit. Perhaps this account will encourage readers to call our attention to other unusual features.

PATHOLOGICAL DIVISION

Correspondence

The Editor of PLANTERS' BULLETIN *invites letters of general interest for publication in this column. Comment and queries arising from articles recently published will be welcome. The name and address of the writer must be given in full, but may be withheld from publication if desirable.*

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MECHANICAL CULTIVATION

Planters may be interested in the following brief report on methods of cultivation under young rubber.

Figure 1

Manuring—Mechanical application of manures to young rubber is illustrated in *Figure 1* which shews a Ferguson tractor with an offset disc harrow on which is fixed a wooden box capable of holding 2 cwt of manure. A boy sits on the box and as the tractor passes each tree he puts a tin measure of manure down a chute attached to the box and sited so that the manure falls between the front and near discs. The harrows spread the manure. This is repeated on either side of the rows of rubber and on an average costs $1.35 per acre.

Figure 2

Discing covers—For a cheap and effective method of controlling inter-row covers disc harrows are used as illustrated in *Figure 2.* This costs on an average $1.25 per acre. Average girth measurements taken of trees which have had this mechanical method of cultivation for the past three years is just over 3 inches per annum.

Klabang Estate
K. Brown
Manager

Our Soils Chemist visited this estate in June. The manager has taken full advantage of the flat land and the ease with which the sandy soil can be cultivated, to develop this economical cover control. The system is being used with success on immature trees up to five years old, mostly in hedges 30 feet apart. Very little cutting of lateral roots appeared to have occurred. We much appreciate the opportunity of publishing this letter. Mechanical cultivation is of growing interest to our readers, and these columns

may well afford a forum for exchange of views and experience on the subject.
—Editor

Figure 3. Lateral roots exposed 3 feet from tree, showing how few suffer damage from the harrows when manure is being applied.

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ABNORMAL FRUITING

Enclosed please find fruit of a PB 86 budded plant, which might be of some interest to you. Year of planting was 1949. Year of budding 1950. This tree was suffering from root disease of the *Fomes* variety.

for Dunlop Malayan Estates Ltd
Regent Estate
E.A.N. Robinson
Acting Manager

The photograph above was taken after the specimen had arrived at the R.R.I. The bunch contained no fewer than twentyfive fruits, of which four had dropped off in transit. Abnormal flowering and fruit setting may be stimulated by pathological conditions.

Clone PB 86 holds the record for early flowering; buddings of 9 and 10 months flowered profusely on two estates near Kuala Lumpur in September 1949, an abnormally dry year. Clone Gl 1 has been known to flower in its second year. Such flowers do not often set fruit although we have one record in which buddings of clone PB 86 produced seed within eighteen months of budding.

Can any reader improve on these records of precocity?

Prolonged dry weather, root disease, budding on to a weak stock, use of buds from a flowering branch are all factors which may cause early flowering.
—Editor

Seed of *Flemingia congesta*, giving 73% germination after hot water treatment, has been distributed to 26 estates which applied for a supply. This leguminous bush cover is described in P.B. 5.

Anthracnose

ANTHRAX, the serious animal disease on which much pioneer bacteriological research was carried out, has given its name to a type of plant disease totally unrelated in everything except the appearance of its symptoms. In plant pathology 'anthracnose' (meaning 'anthrax disease') refers to maladies with characteristic lesions consisting of a well defined margin enclosing numerous pustules. They are generally caused by a group of fungi which bear their spores in cheesy masses, the pustules being formed by the masses forcing their way through the cuticle. Small and colourless as the individual spores are, these cheesy masses are readily visibly to the naked eye and usually appear pink or orange.

Figure 1. A leaflet of clone RRI 501 showing clearly the concentric form of the anthracnose lesion.

The anthracnose fungi are an important group as they attack a large number of cultivated crops in both temperate and tropical regions; one species of these fungi may attack a number of different species of plant, and there is an anthracnose common to tea, coffee, *Ficus* rubber and *Hevea* rubber. It is only comparatively recently that the anthracnose of *Hevea (Colletotrichum ficus)* has attracted attention, although it was first recorded thirty years ago. We here describe this very easily recognised malady and the measures required to control it.

Figure 2. A shoot of clone RRI 623 heavily attacked by anthranose.

Figure 1 shows a leaflet bearing six exceptionally well developed lesions—three large and three small. The central point of infection of the lesion is usually at the edge of the leaf, and is surrounded by concentric zones formed by lines of stout hairs associated with the sporing pustules. Similar zonation is shown by the leaves of the other plantation crops when infected with this fungus.

There is one important point; this form of lesion develops only under special soil conditions. Inoculation of plants growing under ordinary field conditions gives rise to only small lesions. All known cases of the disease (we have recorded several dozen since 1948), have been on plants growing under locally waterlogged conditions. The plants have been almost invariably young buddings, and the effect of the disease is shown in *Figure 2*. The black and white photograph shows how there is shrivelling at the edges of the leaf; a coloured reproduction would show also the unhealthy yellow green colour of the whole flush. This budding was situated in a well drained sandy nursery, but it was in a corner between two bunds where water was apt to collect. A situation in which the disease has frequently been found is on terraced hills in places where the terrace slopes in towards the hill and carries standing water, despite good drainage as a whole.

The remedy is obvious: it is to dig the soil in the vicinity of affected plants so that surplus water runs away. No fungicide is required; indeed, the appearance of the fungus should be looked upon as indicating that growth conditions need to be improved for the general well-being of the plant.

PATHOLOGICAL DIVISION

Air Dried Sheet

AIR DRIED SHEET IS MANUFACTURED in essentially the same way as R.S.S. except that it is dried in a smoke free atmosphere. If the procedure is carefully controlled very light coloured sheet can be prepared. Because of its light colour it can be used as a substitute for pale crepe in the manufacture of certain rubber articles which require, for instance, flexibility or translucency combined with a pale shade. The price premium over R.S.S. which air dried sheet commands depends therefore to some extent on the differential in price between pale crepe and R.S.S. and has varied in recent months between 5 and 15 cents per pound. Considerable interest in the product has been shown by a number of estates and it is thought that the following notes on the methods of production may assist those who are intending to manufacture air dried sheet.

As in normal sheet manufacture it is important that the latex reaches the factory in good condition so that fermentation does not develop, giving bubbles in the final sheet. Particular attention should be paid to this when air dried sheet is to be manufactured since there is not at present any ready market for No. 2 grade and sheets containing bubbles have to be smoked before they are saleable.

It is well known that if coagulum is exposed to the air a purplish colour develops on the surface due to oxidation, and the areas affected show up as dark patches in the final sheet. In air dried sheet this is regarded as a serious defect, and we have found that the discolouration can be reduced to negligible proportions by flooding the surface of the coagula in the tanks with a one third per cent solution of sodium bisulphite; the normal procedure in R.S.S. manufacture of flooding the tanks with water is not sufficient. To obtain the best results the solution should be applied as soon as possible after coagulation has occurred.

Air dried sheet is much more susceptible to contamination by mould growths than is smoked sheet, since the natural fungicidal materials which are absorbed from wood smoke during treatment in a smoke house are not present. It is therefore essential to disinfect berotis and drying sheds with a solution of formaldehyde (*c* 1%) and it is advisable to treat the sheets with a fungicide. A number of new materials have been tested but para-nitrophenol (P.N.P.) still holds its place as the most effective. This chemical can be used in two ways: (*a*) an appropriate quantity is added to the latex before coagulation, or dissolved in the acid used for coagulation; (*b*) the freshly rolled sheets are soaked in a dilute solution of the chemical. The first method is the simpler and the more effective, but P.N.P. has a slight clotting effect on latex which may lead to trouble with bubbles, under certain conditions.

(*a*) *Incorporation of the P.N.P. with latex* — A 1% solution of P.N.P. in water is prepared and added to the diluted latex or acid in the proportion of 1 gallon of solution to 100 lb dry rubber (equivalent to 1 lb P.N.P. to 1,000 lb rubber). If this dose causes clotting it may be possible to combine the two methods of treatment, adding a smaller amount of P.N.P. to the latex and afterwards soaking the sheets in a solution of P.N.P.

(*b*) *Soaking sheets in a solution of P.N.P.* — In this method the freshly rolled sheets are soaked in a 0.1% (1/1,000) solution of P.N.P. for 10 to 15 minutes. The solution is made up in the proportion of 1 lb of P.N.P. to 100 gallons of water. The chemical dissolves slowly in cold water but readily in boiling water. One gallon of boiling water is sufficient for 1 lb P.N.P. The hot solution is poured into the tank containing the bulk of the water, after straining through mesh to remove any black sediment left undissolved. Alternatively a stock solution of 1 lb P.N.P. in 10 gallons of water may be prepared and diluted as required.

The sheets should be placed singly in the tank of solution, each sheet being pushed well under the surface of the liquid before the next sheet is placed on top of it. This is to ensure that the whole surface of each sheet comes in contact with the chemical. If a mass of sheets is placed in the tank the solution will not be absorbed by the sheets in the centre of the pile. After soaking for the required period the sheets are removed and hung to drain. For treatment of approximately 1,000 lb rubber 100 gallons 0.1% P.N.P. solution are sufficient.

DRYING

At the R.R.I. Experiment Station at Sungei Buloh a drier of two compartments, with a total capacity of 4000 lb rubber and an output of 1000 lb/day, is used for drying the sheets. It is heated by steam pipes, arranged so that the temperature of each compartment can be varied independently.

During the first two days of drying care must be taken to limit the temperature to 120 – 125°F since otherwise substantial darkening of the sheet occurs. During the last two days the temperature can be raised to 145 – 150°F. Coagulation at a d.r.c. of 1¼ lb/gal rather than at the normal 1½ lb/gal gives a sheet of better appearance and also speeds the drying.

It is possible to produce air dried sheet without artificial heating but the risk of defects developing is greater, much more drying space

is required, and the sheet may be duller in appearance. However, if special care is taken, a product can be obtained which is acceptable to some buyers.

Apart from the foregoing, attention must be paid to normal precautions in sheet manufacture such as adequate water supply to the sheeting battery, cleanliness of tanks and utensils, *etc.* These are dealt with in R.R.I. *Information Cards Nos. 4 & 5.*

Reprints of this article may be obtained on request.

CHEMICAL DIVISION

Stability and Mineral Composition of Hevea Latex

Investigations on a group of mature seedling trees at the R.R.I. Experiment Station have indicated that latex stability is affected by fertiliser treatments and is also associated with the amount of mineral constituents in the latex. In Communication 284 (in press) of the R.R.I. Journal, M. Philpott and D. Westgarth have described how manuring with phosphate and potash fertilisers appears to have reduced the magnesium content and raised the phosphorus and probably the potassium content of the latex, and at the same time to have increased the mechanical stability. Clonal latices from different estates were also examined. Some inconsistencies in the clonal comparisons were revealed but these can probably be attributed to local factors such as soil condition. However, some clones (notably Glenshiel 1) were shown to yield latex of abnormal stability wherever they were planted. The investigations support the belief that the relationship between the phosphate and magnesium constituents is an important factor governing the natural stability of ammonia preserved latex.

Phosphatides in Latex

Phosphatides, which are fats containing phosphorus, are widespread in both animals and plants —a particularly rich source is egg yolk. They occur to an extent of about 1% in latex and since they possess strong emulsifying powers are probably, in part, responsible for the stability of fresh latex. These substances have been studied by Dr R.H. Smith in our Chemical Division and the first of a series of papers describing this work, entitled 'The Phosphatides of the Latex of Hevea Brasiliensis', will appear in due course in the Biochemical Journal, published by the Cambridge University Press. An account is also being prepared specially for the rubber producing industry of Malaya and will appear in the Journal of the R.R.I.

It has previously been suggested that a gradual destruction of the phosphatides during storage of fresh latex might explain loss of stability and spontaneous coagulation. It has now been shown that although a small amount of destruction does sometimes occur in this period, the effect is not sufficiently consistent to account in general for spontaneous coagulation.

At least three different phosphatides exist in fresh latex, the

principal one containing choline in a combined form. Choline, a substance of outstanding biological interest in both animals and plants, also happens to be a moderate vulcanisation accelerator of rubber. Now, although the phosphatides change little or not at all on storage of untreated fresh latex, coagulation of the latex by acidifying slightly, by adding alcohol or by freezing was found to lead to the rapid splitting off of choline in a water soluble form (the phosphatide is insoluble in water). This liberation, which is due to the action of a biological catalyst or enzyme, occurs during coagulation in normal commercial practice. It means that some of the choline in the latex goes into the serum and not into the rubber. When fresh latex is stored, this enzyme is progressively destroyed. Consequently, more choline is split off from the phosphatide and lost into the serum when freshly collected latex is coagulated than when the latex is stored for some hours before coagulation. Thus the vulcanising properties of the rubber may vary with the age of the latex coagulated, a possibility to be examined in practice.

R. T. D.

The Annual Report for 1952 of Rubber Technical Developments Limited describes, in particular, the development of cyclised rubber from natural rubber, and the successful establishment and operation of pilot plant at the R.R.I. Experiment Station at Sungei Buloh. In view of the increasing popularity, especially in the U.S.A., of resin rubber soling materials based on synthetic copolymers special attention has been devoted to the subject. R.T.D. state that the time is fast approaching when supplies of cyclised natural rubber suitable as a low gravity non-black reinforcing agent will be available commercially. This important material can replace special synthetic products, the high styrene butadiene co-polymers.

T. C. R.

Steady progress is being made with the technical classification of Malayan rubber. The output in all grades has increased from 22,000 to 31,500 tons per annum in the last six months. To cope with the large increase in the number of samples examined a new testing station is being constructed, which should be operating before the end of 1953.

Over 80 of the 100 estates cooperating are now shipping classified rubber and new estates continue to enter. The bulk of the production is still RSS 1, although quantities of lower grades of smoked sheet, brown and pale crepes and air dried sheet are being classified.

The amount of packing house rubber being classified has doubled in the last six months. A sheet blending procedure is required to produce consignments as uniform as classified rubber from estates. The method involves a slight increase in packing costs, of the order of $\frac{1}{4}$ cent/lb, which must be recovered by the packing house to make the procedure economic. Although consumers have shown considerable interest in classified F.A.Qs, the output must be increased before they can benefit from the improved uniformity.

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THE PHOTOGRAPH ON THE FRONT COVER SHOWS DETAILS OF THE SPRAY BOOM FITTED TO A BEAVER AIRCRAFT USED IN TRIALS DESCRIBED IN OUR CURRENT EDITORIAL.

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